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IS 15885-2-8 (2011): SAFETY OF LAMP CONTROLGEAR Part 2: Particular Requrements, Section 8: Ballasts for Fluorescent Lamps [ETD 23: Electric Lamps and their Auxiliaries]

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भाग 2 विशेष अपेक्षाएँ

अनुभाग 8 प्रतिदीप्त लैम्प के लिए बैलास्ट

Indian Standard

SAFETY OF LAMP CONTROLGEAR

PART 2 PARTICULAR REQUIREMENTS

Section 8 Ballasts for Fluorescent Lamps

ICS 29.140.99

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2011 **Price Group 5**

Electric Lamps and Their Auxiliaries Sectional Committee, ETD 23

FOREWORD

This Indian Standard (Part 2/Sec 8) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric Lamps and Their Auxiliaries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard published in conjunction with Part 1 of this series. The formatting into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when need for them is recognized.

In referring to any of the clauses of IS 15885 (Part 1), specifies the extent to which such a clause is applicable and the order in which the tests are to be performed; they also include additional requirements, as necessary. All sections of Part 2 self-contained and, therefore, do not include references to each other.

Where the requirements of any of the clauses of IS 15885 (Part 1) are referred to in this standard by the phrase "The requirements of clause '*n*' of IS 15885 (Part 1) shall apply", this phrase is interpreted as meaning that all requirements of the clause in question of Part 1 shall apply, except any, which are clearly inapplicable to the specific type of lamp controlgear covered by this standard.

Clauses/Tables which are additional to those of IS 15885 (Part 1) are numbered starting from **101** and additional sub-clauses are numbered with main clause number followed by **101, 102**, etc, for example **7.101**.

Annexes A to K form an integral part of this standard.

Annex K is for information only.

This standard is published in eleven sections. Other sections are:

Section 1	Starting devices (other than glow starters)
Section 2	dc or ac supplied electronic step-down convertors for filament lamps
Section 3	ac supplied electronic ballasts for fluorescent lamps
Section 4	dc electronic ballasts for general lighting
Section 5	dc supplied electronic ballasts for public transport lighting
Section 6	dc supplied electronic ballasts for aircraft lighting
Section 7	dc supplied electronic ballasts for emergency lighting
Section 9	Ballasts for discharge lamps (excluding fluorescent lamps)
Section 10	Electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)
Section 11	Miscellaneous electronic circuits used with luminaires.

The safety requirement of ballasts for fluorescent lamps are presently covered under IS 1534 (Part 1) : 1977 'Ballast for fluorescent lamps: Part 1 For switch start circuits (*second revision*)'. Since safety requirements of all types of lamp controlgear including ballasts for fluorescent lamps have been covered under a new series, IS 1534 (Part 1) : 1977 would accordingly be revised to cover only performance requirements.

Indian Standards in respect of Sections 2, 4, 5, 6, 7, 10 and 11 will be taken up in future depending upon the need.

This standard is based on IEC 61347-2-8 (2000) 'Lamp controlgear — Part 2-8: Particular requirements for ballasts for fluorescent lamps' issued by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY OF LAMP CONTROLGEAR

PART 2 PARTICULAR REQUIREMENTS

Section 8 Ballasts for Fluorescent Lamps

1 SCOPE

This standard (Part 2/Sec 8) specifies safety requirements for ballasts, excluding resistance types, for use on ac supplies up to 1 000 V at 50 Hz, associated with fluorescent lamps with or without pre-heated cathodes operated with or without a starter or starting device and having rated wattages, dimensions and characteristics as specified in IS 2418 (Part 1) : 1977 'Tubular fluorescent lamps for general lighting service : Part 1 Requirements and tests (*first revision*)' and IS 15687 'Single-capped fluorescent lamps'.

This standard applies to complete ballasts and their component parts such as reactors, transformers and capacitors. Particular requirements for thermally protected ballasts are given in Annex B.

Ballasts for conventional operation of lamps at mains frequency are covered, while ac supplied electronic ballasts for high frequency operation are excluded. These are specified in IS 15885 (Part 2/Sec 3) : 2011 'Safety of controlgear : Part 2 Particular requirements, Section 3 ac supplied electronic ballasts for fluorescent lamps'.

Capacitors having a capacitance greater than 0.1 F are covered by IS 1569 : 1976 'Capacitors for use in tubular fluorescent lamps, high pressure mercury vapour lamps and low pressure sodium vapour discharge lamp circuits'. Capacitors having a capacitance less than or equal to 0.1 F are specified in IS QC 302400 : 1994.

Performance requirements are covered in IS 1534 (Part 1) : 1977 'Ballasts for fluorescent lamps: Part 1 For switch start circuits (*second revision*)'.

2 REFERENCES

2.1 The following standards are necessary adjuncts to this standard:

IS No.	*Title*
IS 1569 : 1976	Capacitors for use in tubular fluorescent lamps, high pressure mercury vapour lamps and low pressure sodium vapour discharge lamp circuits
13730 (Part 0/ Sec 1) : 1993	Specifications for particular types of winding wires: Part 0 General requirements, Section 1 Enamelled round copper wire
15885	Safety of lamp controlgear:
(Part 1) : 2011	General requirements
(Part 2/Sec 3)	Particular requirements, Section 3 ac supplied electronic ballasts for fluorescent lamps
IS QC 302400 : 1994	Fixed capacitors for use in electronic equipment sectional specification for fixed capacitors for electromagnetic interference suppression and connection to the supply mains

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 15885 (Part 1) and the following shall apply.

3.1 Rated Temperature Rise of a Ballast Winding (Δt)

Temperature rise assigned by the manufacturer under the conditions specified in this standard

NOTE — The specifications for the supply and mounting conditions of the ballast are given in Annex H.

3.2 Short-Circuit Power (of a Voltage Source)

Quotient of the square of the voltage produced at its output terminals (in open circuit conditions) and the internal impedance of the source (as seen from the same terminals).

4 GENERAL REQUIREMENTS

The requirements of **4** of IS 15885 (Part 1) shall apply, together with the following:

4.1 Capacitors and Other Components

Capacitors and other components incorporated in ballasts shall comply with the requirements of the appropriate Indian Standard wherever exists.

4.2 Thermally Protected Ballasts

Thermally protected ballasts shall comply with the requirements of Annex B.

5 GENERAL NOTES ON TESTS

The requirements of **5** of IS 15885 (Part 1) shall apply, together with the following:

5.1 The type test is carried out on sample consisting of eight ballasts submitted for the purpose of the type test. Seven ballasts are for the endurance test and one for all other tests. For conditions of compliance for the endurance test, *see* **13**.

In addition, six ballasts are required for the high-voltage impulse testing according to **15**, for ballasts intended for circuits in which high-voltage impulse occurs within the ballast. There shall be no failure during the test.

5.2 The tests are made under the conditions specified in Annex H of IS 15885 (Part 1). In general, all the tests are carried out on each type of ballast or, where a range of similar ballasts is involved, on each rated wattage in the range, or on a representative selection from the range as agreed with the manufacturer. A reduction in the number of samples for the endurance test, according to **13** and including the use of constant *S* other than 4 500, as shown in Annex E, or even the omission of these tests, is allowed when ballasts of the same construction but with different characteristics are submitted together for approval, or when test reports form the manufacturer or other authority are accepted by the testing station.

6 CLASSIFICATION

The requirements of **6** of IS 15885 (Part 1) shall apply.

7 MARKING

Ballasts which from an integral part of the luminaire need not be marked.

7.1 Mandatory Marking

Ballasts, other than integral ballasts, shall be clearly and durably marked, in accordance with **7.2** of IS 15885 (Part 1), with the following mandatory markings:

a) **7.1** (a), (b), (e), (f) and (g) of **7.1** of IS 15885 (Part 1), together with; and
b) Peak value of the voltage produced, if the peak value exceeds 1 500 V, with connections subjected to this voltage marked as such.

Pulses generated by a glow starter and ballast combination are exempt from this requirement.

7.2 Information to be Provided, if Applicable

In addition to the above mandatory markings, the following information, if applicable, shall be given either on the ballast, or be made available in the manufacturer's catalogue or similar:

a) **7.1** (c), (h), (j), (k), (m), (n), (p) and (q) of IS 15885 (Part 1), together with;
b) In the case of a ballast consisting of more than one separate unit, the current controlling inductive element(s), marked with the essential details of the other unit(s) and/or essential capacitors; and
c) In the case of an inductive ballast used with a separate series capacitor other than a radio interference suppression capacitor, repetition of the marking of rated voltage, capacitance and tolerance.

7.3 Other Information

Manufacturers may provide the following non-mandatory information, if available:

> the rated temperature rise of the winding following the symbol Δt, values increasing in multiples of 5K.

Additional Sub-clause

7.101 The ballast for fluorescent lamps may also be marked with the Standard Mark.

7.101.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 PROTECTION AGAINST ACCIDENTAL CONTACT WITH LIVE PARTS

The requirements of **10** of IS 15885 (Part 1) shall apply.

9 TERMINALS

The requirements of **8** of IS 15885 (Part 1) shall apply.

10 PROVISIONS FOR EARTHING

The requirements of **9** of IS 15885 (Part 1) shall apply.

11 MOISTURE RESISTANCE AND INSULATION

The requirements of **11** of IS 15885 (Part 1) shall apply.

12 ELECTRIC STRENGTH

The requirements of **12** of IS 15885 (Part 1) shall apply.

13 THERMAL ENDURANCE TEST FOR WINDINGS

The requirement of **13** of IS 15885 (Part 1) shall apply.

14 BALLAST HEATING

Ballasts, including their mounting surfaces, shall not attain a temperature which would impair safety.

Compliance is checked by the tests of **14.1** to **14.4**.

14.1 Pre-test, Checks and Measures

Before the test, the following is checked and measured;

a) Ballast starts and operates the lamp(s) normally, and
b) Resistance of each winding is measured at the ambient temperature, if required.

14.2 Voltage Across Capacitors

At rated frequency, the voltage across a capacitor incorporated in ballast shall comply with the requirements given in items (a) and (b). Such requirements do not apply to the capacitors in starters or starting devices or to those having a capacitance less than or equal to 0.1 F (nominal). Neither do the requirements of item (b) apply to self-healing capacitors.

a) Under normal conditions, when the ballast is tested as at its rated supply voltage, the voltage across the capacitor shall not exceed the rated voltage of the latter.
b) Under normal conditions (*see* **14.3**) when the ballast is rated at 110 percent of its rated supply voltage, the voltage across the capacitor shall not be greater than the appropriate test voltage of the capacitor given in Table 1.

14.3 Ballast Heating Test

When the ballast is tested ion accordance with the conditions of Annex K, the temperature shall not exceed the appropriate values given in Table 2 for the tests under normal and abnormal conditions, if applicable.

NOTE — Abnormal circuit conditions are detailed in relevant parts of IS 10322.

Table 1 Abnormal Conditions — Capacitor Test Voltages
(*Clause*14.2)

Sl No. (1)	Designation (2)	Related Voltage (3)	Limiting Voltage U_n (4)
i)	Any	Rated voltage of 240 V or less, 50 Hz and maximum rated temperature less than or equal to 50°C	1.25 U_n
ii)	Non-self-healing	Other ratings, 50 Hz	1.50 U_n
iii)	Self-healing	Other rating, 50 Hz	1.25 U_n

For ballasts which are subjected to an endurance test duration of longer than 30 days, the limiting temperatures shall be calculated using equation 2 of **13** of IS 15885 (Part 1), but for an objective test life (in days) equal to two-third of the theoretical endurance test period.

14.4 After these heating tests, the ballast shall be allowed to cool to room temperature and shall comply with the following conditions:

a) Ballast marking shall still be legible;
b) Ballast shall without damage a voltage test according to **12**, the test voltage, however, being reduced to 75 percent of the values given in IS 15885 (Part 1), but not less than 500 V.

15 HIGH-VOLTAGE IMPULSE TESTING

Ballasts marked in accordance with **7.1** additional requirements shall be subjected to the test either in **15.1** or **15.2**.

Simple reactor type ballasts shall be subjected to the test given in **15.1**.

Ballasts other than simple reactor type ballasts shall be subjected to the test given in **15.2**. The manufacturer shall declare to which test his product has been subjected.

15.1 From the six samples specified in **5.1** three are subjected to the moisture resistance and dielectric strength test specified in **11** and **12**.

The remaining three samples are heated in an oven until they attain the temperature t_w marked on the ballasts.

Immediately following these pre-conditioning tests, all six samples shall withstand the high voltage impulse test.

The ballasts under test, together with a variable resistor and a suitable circuit breaker with a closing time (bounce time excluded) between 3 ms and 15 ms, for example, a vacuum switch type H16 or VR312/412 is connected to a dc current in such a way that, by adjusting the current and operating the circuits breaker, voltage pulses will be induced in the ballast. The current is then adjusted slowly, increasing so that the peak voltage marked on the ballast is reached. The measurement of the voltage pulses is made directly at the ballast terminations and in accordance with Annex J.

The value of the dc current at which the starting voltage is reached is noted. The samples are then operated with this current for 1 h and the current is interrupted during this time, 10 times for 3 s within every minute.

Immediately after the test all six ballasts shall withstand

Table 2 Maximum Temperatures

(*Clause* 14.3)

Sl No.	**Parts**	**Maximum Temperature °C**		
		Normal Operation at 100 Percent of Rated Voltage	Normal Operation at 106 Percent of Rated Voltage	Abnormal Operation at 110 Percent of Rated Voltage
(1)	(2)	(3)	(4)	(5)
i)	Ballast winding with declared temperature rise Δt	a)		
ii)	Ballasts winding with declared temperature under abnormal conditions			b)
iii)	Capacitor, if any, adjacent to the ballast case:			
	a) Without temperature declaration		50	
	b) With indication of t_c		t_c	
	Part made of:			
iv)	a) Wood-filled phenolic mouldings		110	
	b) Mineral-filled phenolic mouldings		145	
	c) Urea mouldings		90	
	d) Melamine mouldings		100	
	e) Laminated, resin bonded paper		110	
	f) Rubber		70	
	g) Thermoplastic materials		c)	

NOTES

1 If materials or manufacturing methods are used other than those indicated in this table, they must not be operated at temperatures higher than those which are proved to be permissible for those materials.

2 The temperature in this table must not be exceeded when the ballast is operated at this maximum declared ambient temperature, if any. Maximum ambient temperature for a ballast, if not declared, must be considered as the difference between t_w and the measured winding temperature rise at Δt at 100 percent nominal voltage.

a) The measurement of the temperature rise of the windings normal conditions at 100 percent of rated voltage that is, verification of a declared vale so as to provide information for luminaire design-is non-mandatory and its measurement is only performed when marked on the ballast or otherwise required in the catalogue.

b) This measurement is only mandatory for circuits which may produce abnormal conditions. The declared limiting temperature of the windings under abnormal condition shall not be higher than the value which corresponds to a number of days equal to at least two-thirds of the theoretical endurance test period (*see* Table 3).

c) The temperature of thermoplastic material, other than that used for the insulation of the wiring, which provides protection against contact with live parts or supporting such parts is also measured. Values thus obtained serve to establish the conditions of the test of IS 15885 (Part 1).

Table 3 Limiting Temperatures of Winding Under Abnormal Operating Conditions and at 110 Percent of Rated Voltage for Ballasts Subjected to an Endurance Test Duration of 30 Days

(*Table* 2)

Sl No.	**Constants *S***	**Maximum Temperature °C**					
		S 4,5	S 5	S 6	S 8	S11	S16
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	For t_w = 90	171	161	147	131	119	110
ii)	95	178	168	154	138	125	115
iii)	100	186	176	161	144	131	121
iv)	105	194	183	168	150	137	126
v)	110	201	190	175	156	143	132
vi)	115	209	198	181	163	149	137
vii)	120	217	205	188	169	154	143
viii)	125	224	212	195	175	160	149
ix)	130	232	220	202	182	166	154
x)	135	240	227	209	188	172	160
xi)	140	248	235	216	195	178	166
xii)	145	256	242	223	201	184	171
xiii)	150	264	250	230	207	190	177

NOTE — Unless otherwise indicated on the ballast, the limiting temperature specified in col 3 apply.

the moisture resistance and insulation test specified in **11** and **12**.

NOTES

1 If electronic circuits breakers with a very shortly closing time are used, care must be taken against producing a very high induced pulse voltage.

2 For testing circuits with series capacitors, the capacitor must be short-circuited.

15.2 Without connection of the lamp on the output side of the ballast, the supply voltage is adjusted in order to obtain the pulse voltage, generated by the starter and the ballast, of the marked value on the ballast. Cathode heating windings of the ballast are loaded with dummy resistors.

Then, the ballast is operated under these conditions without a lamp for a period of 30 days.

Number of samples, before-test treatment and conditions after the test are the same as those prescribed in **15.1**.

Ballasts which are marked for exclusive use with an ignitor having a time delay device are subjected to the same test, but for a period consisting of 250 on/off cycles, keeping an off period of at least 2 min.

16 FAULT CONDITIONS

The requirements of **14** of IS 15885 (Part 1) are not applicable.

17 CONSTRUCTION

The requirements of **15** of IS 15885 (Part 1) shall apply.

18 CREEPAGE DISTANCES AND CLEARANCES

The requirements of **16** of IS 15885 (Part 1) shall apply, together with the following:

In open-core ballasts, enamel, or similar material which forms the insulation for a wire and withstands the voltage test for Grade 1 or Grade 2 of IS 13730 (Part 0/Sec 1) (**13**) is judged to contribute 1 mm to the values given in Tables 3 and 4 of IS 15885 (Part 1) between enameled wires only in the situation where creepage distances and clearances are not less than 2 mm in addition to the enameled layers.

19 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

The requirements of **17** of IS 15885 (Part 1) shall apply.

20 RESISTANCE TO HEAT, FIRE AND TRACKING

The requirements of **18** of IS 15885 (Part 1) with the exception of **18.5**, shall apply.

21 RESISTANCE TO CORROSION

The requirements of **19** of IS 15885 (Part 1) shall apply.

ANNEX A

(*Foreword*)

TEST TO ESTABLISH WHETHER A CONDUCTIVE PART IS A LIVE PART WHICH MAY CAUSE AN ELECTRIC SHOCK

The requirements of Annex A of IS 15885 (Part 1) shall apply.

ANNEX B

(*Foreword* and *Clauses* 1 *and* 4.2)

PARTICULAR REQUIREMENTS FOR THERMALLY PROTECTED LAMP CONTROLGEAR

The requirements of Annex B of IS 15885 (Part 1) shall apply.

ANNEX C

(*Foreword*)

PARTICULAR REQUIREMENTS FOR ELECTRONIC LAMP CONTROLGEAR WITH MEANS OF PROTECTION AGAINST OVERHEATING

The requirements of Annex C of IS 15885 (Part 1) do not apply.

ANNEX D

(*Foreword*)

REQUIREMENTS FOR CARRYING OUT THE HEATING TESTS OF THERMALLY PROTECTED LAMP CONTROLGEAR

The requirements of Annex D of IS 15885 (Part 1) shall apply.

ANNEX E

(*Foreword* and *Clause* 5.2)

USE OF CONSTANT S OTHER THAN 4 500 IN t_W TESTS

The requirements of Annex E of IS 15885 (Part 1) shall apply.

ANNEX F

(*Foreword* and *Clause* K-3)

DROUGHT-PROOF ENCLOSURE

The requirements of Annex F of IS 15885 (Part 1) shall apply.

ANNEX G

(*Foreword*)

EXPLANATION OF THE DERIVATION OF THE VALUES OF PULSE VOLTAGES

The requirements of Annex G of IS 15885 (Part 1) shall apply.

ANNEX H

(*Foreword* and *Clauses* 3.1 *and* 5.2)

TESTS

The requirements of Annex H of IS 15885 (Part 1) shall apply.

ANNEX J

(*Clause* 15.1)

METHOD FOR SELECTION OF VARISTORS

J-1 GENERAL

In order to avoid voltage variations during measurement of voltage pulses, a number of varistors in series is connected in parallel to the ballast under test.

Due to the energy involved, the smallest types of varistors are sufficient for this purpose.

The voltage built up within the ballast depends not only on its inductance, the dc current and the capacitance C_2, but also on the quality of the vacuum switch, as part of the energy stored in the ballast will be discharged via the spark occurring at the switch.

Therefore, it is necessary to select the varistors together with the switch used for the circuit.

Due to the fact that the varistors have tolerances, which may add or compensate themselves, an individual selection is necessary for each of ballast to be tested.

J-2 SELECTION OF THE VARISTORS

The ballast current is first adjusted so that voltage across C_2 is approximately 15 percent to 20 percent higher than the foreseen test voltage.

The voltage is then reduced to the intended value by means of varistors connected in series.

It voltage to take two or tree high-voltage varistors to cover the greatest part of the test voltage and to use one or two varistors of lower the rest of the test voltage. Varying the current through the ballast can then make the fine adjustment of the test voltage.

Approximate values for the voltage of the single varistors can be chosen from the voltage current characteristics given in the relevant varistors data sheets (for example, voltage value at I=10 mA).

ANNEX K

(*Foreword*)

EXPLANATION OF BALLAST TEMPERATURES

(This Annex does not introduce any new proposal but reflects the current states of the requirements)

The object of ballast temperature requirements is to verify that the ballast functions safely during its intended life.

Ballast life is determined by the quality of the wire insulation connected with the ballast construction.

The thermal behaviour of a thus characterized by the following aspects:

a) endurance,
b) ballast heating, and
c) test arrangement.

The following explanation applies to coil type ballasts.

K-1 ENDURANCE

The starting point is the claimed ballast winding temperature t_w denoting the temperature which give a life expectancy of at least 10 years' continuous operation at the temperature. The relation between winding temperature and ballast life can be calculated from the following equation:

$$\log L = \log L_o + S(1/T - 1/T_w) \quad \text{...1}$$

where

L = objective test life in days, 30 days being the standard but the manufacturer may ask for a longer testing time at a related lower temperature;
L_o = 3 652 days (10 years);
T = theoretical test temperature $(t + 273)$ K;
T_w = rated maximum operating temperature $(t_w + 273)$ K; and
S = constant depending on the design of the ballast and the winding insulation used. If no claim is made to the contrary, S is taken to be 4 500 but a manufacturer may claim the use of other values if this is justified by the relevant tests.

Consequently the endurance test can be carried out in a much shorter time than 10 years at a related higher winding temperature. The standard endurance test period is 30 days, but longer test durations, up to 120 days permitted.

K-2 BALLAST HEATING

For ballasts designed to be built into a luminaire, it should be checked that the assigned ballast winding temperature (t_w) in the luminaire, is not exceeded under normal operating conditions, in accordance with the luminaire standard.

Moreover, under abnormal operating conditions, such as a short-circuited started in a fluorescent lamp circuit, the luminaire is checked to see that the relevant limit which has to be marked on the ballast is not exceeded. This limit is specified as the temperature corresponding to a life of two-thirds of the test time for the ballast endurance test. This requirement is based on and derived form the tables with limiting temperatures and theoretical test temperatures for a ballast subject to an endurance test duration of 30 days and based on the assumption that a t_w 90 ballast is comparable in requirements to ballast without temperature marking, and with layers separated by paper.

The above information means that the limiting temperature under abnormal conditions is for example the temperature corresponding to a 20-day life span for a ballast subjected to a 30 days endurance test. This relation is base on the traditional limits for the limiting temperature of windings and the objective test temperature for the endurance test. However, the manufacturer is free to mark a lower temperature if he so wishes.

Verification in the luminaire is based on the limiting values marked on the ballast. This implies that if a manufacturer has elected to use a longer endurance test, at a correspondingly lower temperature, then the maximum permissible temperature under abnormal conditions is correspondingly reduced.

K-3 TEST ARRANGEMENT

Originally, ballast temperatures were checked on a ballast in a test arrangement which was a simulation of a batten luminaire (*see* Fig. 1) modified several times to improve reproducibility. The latest test arrangement is with the ballast lying on wooden supports {*see* Fig. 7 of IS 15885 (Part 1)}. Practice has shown, however, little or no correlation between the temperatures measured on the ballast in that test arrangement and the actual temperatures when the ballast was built into a particular luminaire. For this reason, measurement of ballast heating in this test arrangement has been dropped and replaced by a much more realistic measurement based on the maximum permitted winding temperature t_w.

The ballast heating test has thus been modified to represent the worst conditions in the luminaire permitted by the ballast manufacturer through the claimed value of t_w. Lamp controlgear parts are then checked with the ballast operating in an oven until the marked winding temperature is reached.

Consequently, verification that the ballast winding temperature is not exceeded takes place in the luminaire. Lamp controlgear winding temperatures are then measured under normal as well as abnormal conditions of operation and compared against the marked values.

Built-in ballasts designed to be built into enclosures other than luminaries, such as a pole, box or the like, are also tested in the test arrangement of Fig. 7 of IS 15885 (Part 1), as specified for built-in ballasts. Since these ballasts are not built into a luminaire, compliance with the temperature limits as specified in the luminaire standard is also checked in this test arrangement.

Independent ballasts are tested in a test corner. The test corner consists of three wooden boards arranged so as to simulate two walls and the ceiling of a room (*see* Fig. 2).

All measurements are carried out in a draught-proof enclosure, as described in Annex F.

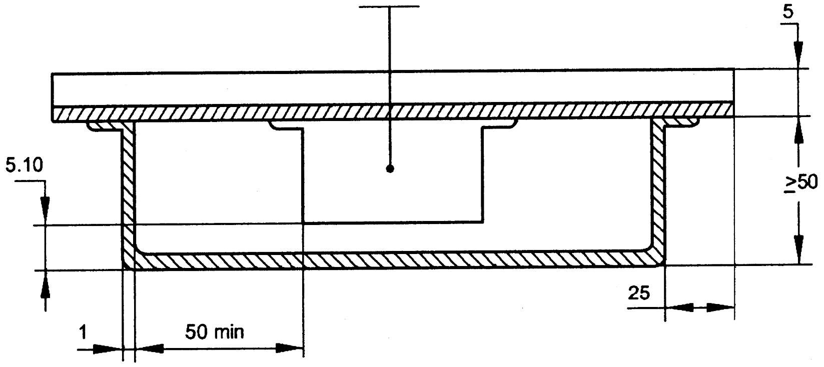

FIG. 1 TEST HOOD FOR BALLAST HEATING TEST

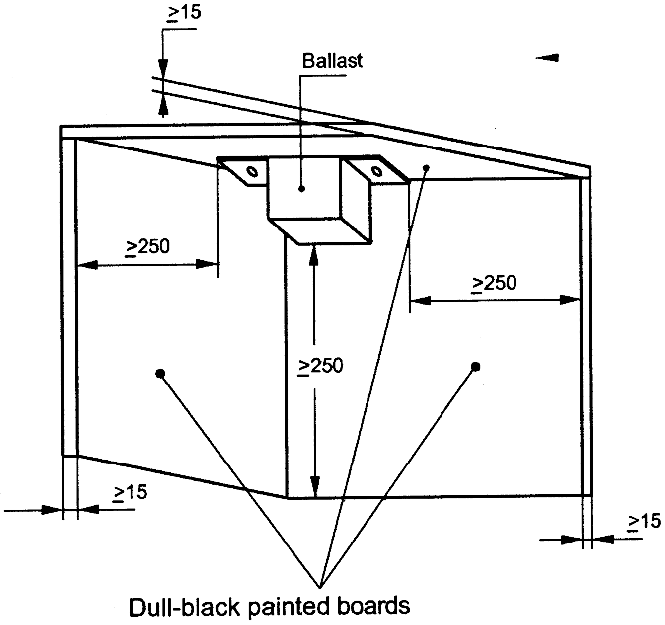

FIG. 2 TEST CORNER FOR BALLAST HEATING

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